Esfuerzos Principales y Criterios de Falla

- **Esfuerzos principales**

$$\sigma_{n_{max}} = \frac{\sigma_i + \sigma_j}{2} \pm \sqrt{\left(\frac{\sigma_i - \sigma_j}{2}\right)^2 + \tau_{ij}^2}$$

$$\tau_{max} = \pm \sqrt{\left(\frac{\sigma_i - \sigma_j}{2}\right)^2 + \tau_{ij}^2}$$

$i, j = x, y$ ó z

$$\tan(2\theta_n) = \frac{2\tau_{ij}}{\sigma_x - \sigma_y}$$

θ_n: Ángulo para el cual los esf. ppales. son máximos

- **Criterios de Falla**

↳ **Factor de Seguridad:** $F_{adm} = \frac{F_{max}}{F.S.}$; $\left(\sigma\right)$

F_{adm}: Fuerza máxima que debe aplicarse por seguridad

F_{max}: Fza máxima que debe aplicarse para que ocurra falla

↳ **Criterio del esf. normal máximo:** $\sigma_{adm} \leq \frac{\sigma_o}{F.S.}$; σ_o: Límite de Fluencia

↳ **Criterio del esf. de corte máximo (Tresca)**

$$\tau_{adm} \leq \frac{\tau_o}{F.S} = \frac{\sigma_o}{2F.S.}$$

↳ **Criterio de Von Mises**

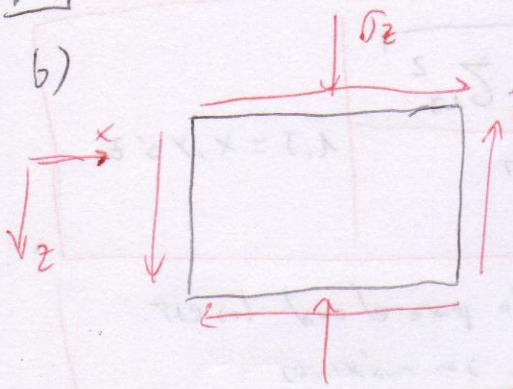
$$\sigma_{VM} \leq \frac{\sigma_o}{F.S} \; ; \; \sigma_{VM} = \sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2}$$

Esf. ppales

* Resolución Criterios de Falla Aux. N° 5 (Esf. Combinados)

P1)

b)



$\sigma_z = -95,552\ [MPa]$

$\tau_{xz} = -63,63\ [MPa]$

$$\rightsquigarrow \sigma_{n_{max}} = \frac{\sigma_z}{2} \pm \sqrt{\left(\frac{\sigma_z}{2}\right)^2 + \tau_{xz}^2} = -47,776 \pm 79,57$$

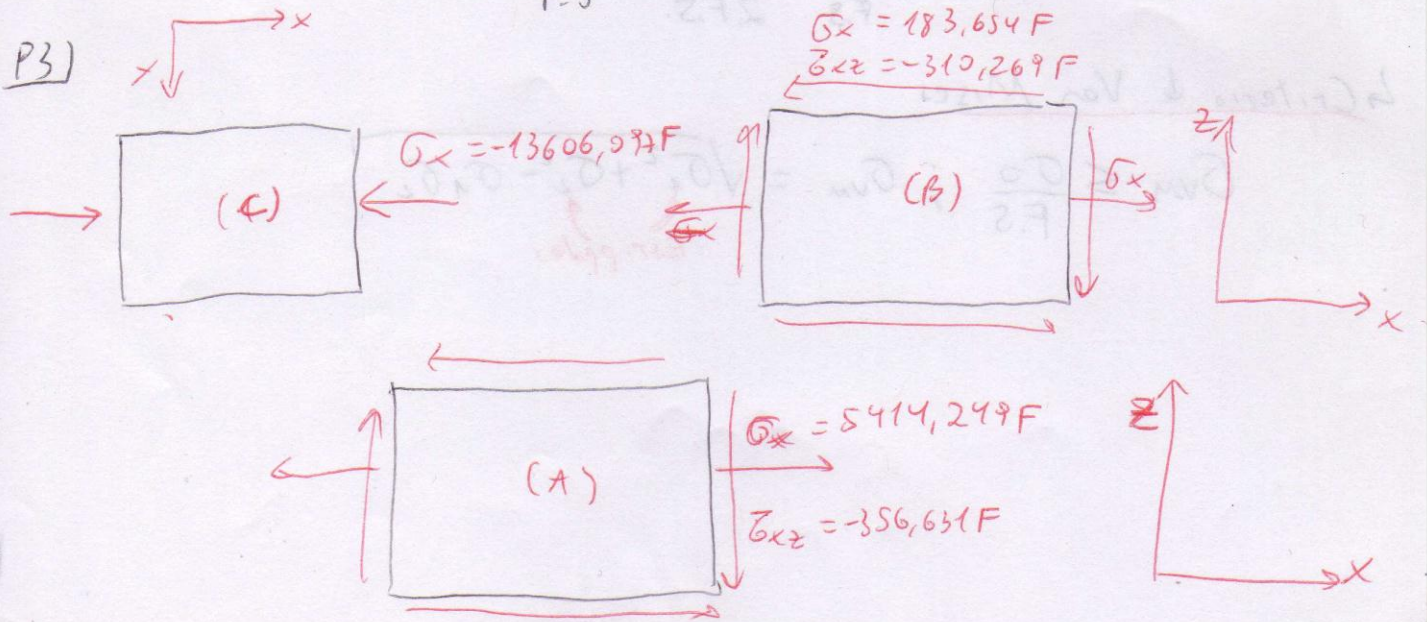
$$\therefore \sigma_{n_{max}} = \begin{cases} \sigma_1 = 31,794\ [MPa] \\ \sigma_2 = -127,346\ [MPa] \\ \tau_{max} = \pm 79,57\ [MPa] \end{cases}$$

$$\rightsquigarrow \sigma_{v.m} = \sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1 \sigma_2} = 145,92\ [MPa]$$

$$\rightsquigarrow \sigma_{adm} = \frac{\sigma_0}{F.S} = \frac{250\ [MPa]}{1,5} = 166,67\ [MPa]$$

$$\therefore \sigma_{v.m} \leq \frac{\sigma_0}{F.S} \rightsquigarrow \text{El material no falla!!}$$

P3)



→ Esf. ppales:

σ_{max}

(A): $\sigma_{n_{max}}^{(A)} = \frac{5414,249F}{2} \pm \sqrt{\left(\frac{5414,249F}{2}\right)^2 + (-356,631F)^2}$

$= 2707,12F \pm 2730,51F$

$\therefore \sigma_1 = 5437,634F$
$\sigma_2 = -23,39F$
$\tau_{max} = \pm 2730,51F$

$\rightsquigarrow \sigma_{VM} = \sqrt{(5437,634F)^2 + (-23,39F)^2 + 5437,634 \cdot 23,39F^2}$

$\sigma_{V.M} = 5449,367F$

$\therefore \sigma_{V.M} \leq \frac{\sigma_0}{F.S} \rightarrow 5449,367F \leq \frac{\sigma_0}{F.S}$

$\therefore F_{(A)} \leq \frac{\sigma_0}{5449,367F.S.} = 24957,027[N]$

(B): $\sigma_n^{(B)} = 91,827F \pm 323,568F$

$\therefore \sigma_1 = 415,394F$
$\sigma_2 = -231,741F$
$\tau_{max} = \pm 323,568F$

$\rightsquigarrow \sigma_{VM} = 567,908F$

$\therefore F_{(B)} \leq \frac{\sigma_0}{567,908F.S} = 23947S,41[N]$

(C) ~~$\sigma_n^{(C)} = \frac{\sigma_x}{2} - 6803,049F \rightarrow \sigma_1 = \sigma_2 = -6803,04$~~

$\sigma_n^{(C)} = -\frac{\sigma_x}{2} \pm \sqrt{\left(\frac{\sigma_x}{2}\right)^2}$

$\sigma_1 = -13606,097F$
$\sigma_2 = 0$
$\tau_{max} = \pm 13606,097F$

$\Rightarrow \sigma_{V.M} = 13606,097F \rightsquigarrow F_{(C)} \leq \frac{\sigma_0}{13606,097F.S.}$

$\therefore F_{(C)} = 9995,52[N]$

$\therefore F \leq 9995,52[N]$ → Carga máxima para que no falle ninguno de los 3 puntos